

The Gandini patent discloses an ultrasonic diagnostic imaging system for three-dimensional imaging. As discussed at column 4, a physician preparing to form three-dimensional ultrasonic images will perform a survey scan of the patient to locate the region of interest (col. 4, lines 4-10). This survey scan is stored in image frame memory, and a Cineloop memory stores a real time two-dimensional image sequence upon command by the user. The Cineloop sequence can be replayed to observe subtleties of tissue motion, such as heart valve performance, which are difficult to detect in real time (col. 4, lines 44-54). Once the region of interest has been selected, the physician positions the probe at one side of the region of interest and acquires the frames that will be used for the three-dimensional reconstruction (col. 5, line 66 through col. 6, line 10). After the sequence of image frames has been acquired, the three-dimensional images are rendered and displayed (col. 6, lines 23-56).

Thus, the Gandini patent discloses a conventional three-dimensional imaging system. There is no suggestion that separate three-dimensional reconstructions should be made from frames acquired at two or more separate phases of the cardiac cycle. Thus, the Gandini patent does not focus on the problem solved by the present invention.

As pointed out in the specification of the present application, the preferred embodiments described in conjunction with the drawings use an EKG signal to store information with each acquired frame. This stored information is indicative of the phase of the cardiac cycle at which the frame was acquired. This phase information is then used to generate 3-D images or extended field of view images, in which each image for display is generated from two or more frames of acquired image data from the same respective phase of the cardiac cycle as is the displayed image. Images with different phases are then displayed in sequence.

Figures 2 and 6 provide examples of the preferred embodiment as applied to three-dimensional imaging and extending field of view imaging, respectively. In Figure 6, image data from three substantially coplanar frames 70, 72, 74 are used to create an extended field of view image. Of importance here is the fact that when the extended field of view image is for a particular phase of the cardiac cycle, (e.g. 0°) image data for the frames 70, 72, and 74 are acquired at the same phase (e.g. 0°) of

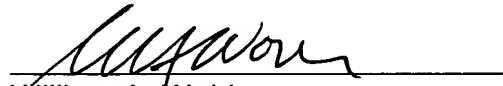
the cardiac cycle. This process is repeated for other phases of the cardiac cycle, and in this way a sequence of extended field of view images (each with a respective phase of the cardiac cycle) is created and displayed. Similarly, in the embodiment of Fig. 2, acquired image data from a particular phase (e.g. 0°) of the cardiac cycle is registered in three-dimensional space and then used to create the desired images from the three-dimensional space. This process is repeated for two or more separate phases of the cardiac cycle. The forgoing specific examples have been provided merely to provide a basis for discussion of the following claims, and these examples should not be used to limit the scope of these claims.

New Claims 24-39 include independent Claims 24 and 32. Note that in Claim 24(b), a first image is generated from an image data from at least two frames associated with a first phase of the physiological cycle, and that in 24(c) a second image is generated from image data from at least two of the frames associated with a second phase of the physiological cycle. In 24(d), the first and second images are displayed in sequence to a user. Thus, the first image is generated from frames with a first phase of the physiological cycle and the second image is generated from frames associated with a second phase of the physiological cycle. These acts are not taught or suggested by the Gandini patent. The discussion in Gandini at col. 4, lines 46-55 makes it clear that the Cineloop sequence shows subtleties of tissue motion such as heart valve performance, but there is no suggestion that two or more images should be generated, each from at least two frames associated with a respective phase of the physiological cycle. For this reason alone, Applicant submits that Claims 24-39 are patentable over Gandini.

With respect to the dependent claims, there is no suggestion in Gandini of extended field of viewing images as defined by Claims 25 and 33, and there is no suggestion that the two frames of (b) be acquired from substantially coplanar, partially overlapping spatial regions. Similarly, there is no suggestion that the image data be registered in at least one extended field of view data set as called for by Claims 31 and 39.

Applicant submits that in view of the foregoing amendments and remarks, all of the pending claims are in condition for allowance. Reconsideration is respectfully requested.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "W. Webb", is written over a horizontal line.

William A. Webb  
Registration No. 28,277  
Attorney for Applicants

BRINKS HOFER GILSON & LIONE  
P.O. BOX 10395  
CHICAGO, ILLINOIS 60610  
(312) 321-4200